



# Vital Signs: Disparities in Tobacco-Related Cancer Incidence and Mortality — United States, 2004–2013

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S. Jane Henley, MSPH<sup>1</sup>; Cheryll C. Thomas, MSPH<sup>1</sup>; Saida R. Sharapova, MD<sup>2</sup>; Behnoosh Momin, DrPh<sup>1</sup>; Greta M. Massetti, PhD<sup>1</sup>; Deborah M. Winn, PhD<sup>3</sup>; Brian S. Armour, PhD<sup>2</sup>; Lisa C. Richardson, MD<sup>1</sup> ([View author affiliations](#))

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## Key Points

- Tobacco use causes at least 12 types of cancer.
- Thirty percent of cancer deaths are caused by cigarette smoking.
- Tobacco-related cancer incidence rates decreased significantly in 44 states.
- Disparities in tobacco-related cancer persist among certain groups with higher rates or slower declines in rates.
- Additional information is available at <http://www.cdc.gov/vitalsigns>.

## Abstract

**Background:** Tobacco use causes at least 12 types of cancer and is the leading preventable cause of cancer.

**Methods:** Data from the United States Cancer Statistics dataset for 2004–2013 were used to assess incidence and death rates and trends for cancers that can be caused by tobacco use (tobacco-related cancers: oral cavity and pharynx; esophagus; stomach; colon and rectum; liver; pancreas; larynx; lung, bronchus, and trachea; kidney and renal pelvis; urinary bladder; cervix; and acute myeloid leukemia) by sex, age, race, ethnicity, state, county-level poverty and educational attainment, and cancer site.

**Results:** Each year during 2009–2013, on average, 660,000 persons in the United States received a diagnosis of a tobacco-related cancer, and 343,000 persons died from these cancers. Tobacco-related cancer incidence and death rates were higher among men than

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women; highest among black men and women; higher in counties with low proportion of college graduates or high level of poverty; lowest in the West; and differed two-fold among states. During 2004–2013, incidence of tobacco-related cancer decreased 1.3% per year and mortality decreased 1.6% per year, with decreases observed across most groups, but not at the same rate.

**Conclusions:** Tobacco-related cancer declined during 2004–2013. However, the burden remains high, and disparities persist among certain groups with higher rates or slower declines in rates.

**Implications for Public Health Practice:** The burden of tobacco-related cancers can be reduced through efforts to prevent and control tobacco use and other comprehensive cancer control efforts focused on reducing cancer risk, detecting cancer early, improving cancer treatments, helping more persons survive cancer, improving cancer survivors' quality of life, and better assisting communities disproportionately impacted by cancer.

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## Introduction

Tobacco use remains the leading preventable cause of disease and death in the United States, resulting in 480,000 deaths and more than \$300 billion in direct health care expenditures and productivity losses each year (1). More than 70 carcinogens have been identified in tobacco smoke and 28 in smokeless tobacco products (2). Cigarette smoking causes cancers throughout the body, including cancers of the oral cavity and pharynx; esophagus; stomach; colon and rectum; liver; pancreas; larynx; lung, bronchus, and trachea; kidney and renal pelvis; urinary bladder; and cervix, as well as acute myeloid leukemia (1,2). Additionally, the use of smokeless tobacco (snuff and chewing tobacco) causes cancers of the oral cavity, pancreas and esophagus (2,3), cigar use causes cancers of the oral cavity, pharynx, esophagus, larynx, and lung (4), and secondhand smoke exposure causes lung cancer (2,5).

Data compiled for the United States Cancer Statistics (USCS) dataset were used to summarize disparities in incidence and death rates and trends during 2004–2013 for cancers that can be caused by tobacco use (tobacco-related cancers). In this report, tobacco-related cancers were defined as those classified by the U.S. Surgeon General as causally related to cigarette smoking (1); those classified also encompass cancers related to other tobacco products (2–4). Trends in all-cancer, lung cancer, and tobacco-related cancer death rates were also examined for 1970–2014.

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## Methods

The USCS dataset is a compilation of data from multiple sources and is used to report the official federal cancer statistics through the USCS web-based report (6). The USCS dataset includes cancer incidence data from the CDC's National Program of Cancer Registries (NPCR) and the National Cancer Institute's (NCI) Surveillance, Epidemiology, and End Results (SEER) program and cancer mortality data from the National Vital Statistics System (NVSS) (6). Data on new cases of cancer diagnosed during 2004–2013 were obtained from population-based cancer registries affiliated with NPCR and SEER programs in each state, the District of Columbia (DC), and Puerto Rico. Data from Puerto Rico met USCS publication criteria for 2009–2013, and data from DC and all states except Nevada met USCS publication criteria for 2004–2013; consequently, incidence data in this report cover 99% of the U.S. population.\* Cancer site for cases was classified by anatomic site and histology.† Only cases of invasive cancer were included, except for urinary bladder cancer, which also included *in situ* tumors.

Data on cancer deaths during 1970–2014 were based on death certificate information reported to state vital statistics offices and compiled into a national file through NVSS. The underlying cause of death was selected according to the version of the *International Classification of Diseases (ICD)* codes and selection rules in use at the time of death (*ICD-6* to

*ICD-10*) and categorized according to SEER site groups to maximize comparability with ICD for Oncology (*ICD-O*) classifications.<sup>§</sup>

Population estimates for rate denominators were annual race-, ethnicity-, and sex-specific county population estimates from the U.S. Census, as modified by NCI and aggregated to the state and national level.<sup>¶</sup> Average annual incidence and death rates for 2004–2008 and 2009–2013 per 100,000 persons were age-adjusted to the 2000 U.S. standard population; in this analysis, death rates were limited to data through 2013, the most recent year for which incidence data were available. Annual percentage change (APC) was used to quantify changes in rates from 2004–2013 and was calculated using least squares regression. Rates and trends were estimated by sex, age, race, ethnicity, U.S. Census region, quartiles of county-level educational attainment (percentage of persons aged  $\geq 25$  years with at least a bachelor's degree), quartiles of county-level poverty (percentage of persons living below poverty threshold), and county-level rural/urban continuum.<sup>\*\*</sup> State-specific age-adjusted tobacco-related cancer incidence rates and APCs were mapped using quartiles as cut points. Cancer deaths attributable to cigarette smoking among adults aged  $\geq 35$  years were based on recent estimates of smoking-attributable fractions ( $\gamma$ ). Annual age-adjusted rates for all-cancer, lung cancer, and tobacco-related cancer deaths were examined for 1970–2014. The number of tobacco-related cancer deaths averted was estimated by subtracting the actual number of deaths each year through 2014 from the number expected if tobacco-related cancer death rates had remained at the peak levels (during 1990, among men, and 1995, among women).

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## Results

During 2009–2013 approximately 660,000 persons received a diagnosis of a tobacco-related cancer each year in the United States, and 343,000 persons died from these cancers ([Table 1](#)). Tobacco-related invasive cancer incidence declined 1.3% per year, from 206 cases per 100,000 during 2004–2008 to 193 per 100,000 during 2009–2013. Tobacco-related cancer mortality declined 1.6% per year from 108 deaths per 100,000 during 2004–2008 to 100 per 100,000 during 2009–2013.

The tobacco-related cancer incidence rate was 1.7 times higher among males (250 per 100,000) than among females (148 per 100,000), as was the death rate (131 per 100,000 males vs. 76 per 100,000 females). Both incidence and death rates of tobacco-related cancer decreased faster during 2004–2013 among males (-1.5% and -1.8%) than among females (-1.2% and -1.4%).

Tobacco-related cancer incidence and death rates increased with age, and one third of cases and two fifths of deaths occurred among persons aged  $\geq 75$  years ([Table 1](#)). Tobacco-related cancer incidence and death rates were highest, but decreased fastest, among blacks compared with other racial/ethnic groups. Tobacco-related cancer incidence and death rates were highest, and incidence decreased slowest, in counties with lowest educational attainment or highest poverty, and were lowest, and decreased fastest, in metropolitan areas with  $\geq 1$  million population.

By region, tobacco-related cancer incidence and death rates were lowest in the West and decreased most slowly in the Midwest ([Table 1](#)). Incidence rates of tobacco-related cancer ranged two-fold among states with available data, from 248 per 100,000 persons in Kentucky to 130 per 100,000 (Utah) and 126 per 100,000 (Puerto Rico) ([Figure 1](#)). The incidence of tobacco-related cancer decreased significantly in 44 states with available data (-0.4% to -2.4%), and did not change significantly in five states and DC ([Figure 1](#)).

By cancer site, incidence and death rates were highest for lung cancer, which accounted for about one third of tobacco-related cancer cases and almost one half of tobacco-related cancer deaths ([Table 2](#)). For each cancer site (except cervix), incidence and death rates were higher among males than females. In 2009–2013, approximately 101,300 men and 65,700

women died of cigarette smoking-attributable cancers each year. Lung cancer caused most of these deaths and had the highest cigarette smoking-attributable fraction (80%).

All cancer death rates peaked in 1990 among males and in 1991 among females ([Figure 2](#)). About 60% of the decrease in all cancer death rates among males was due to decreases in tobacco-related cancers, which also peaked in 1990. Among females, tobacco-related cancer death rates began to decline in 1995 and accounted for 40% of the decrease in all cancer death rates. Due to reductions in tobacco-related cancers, approximately 1,025,000 tobacco-related cancer deaths were averted among men since 1990, and 242,000 among women since 1995.

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## Conclusions and Comments

Tobacco-related cancer death rates in the United States have been declining since 1990 among men and since 1995 among women and continued to decline through 2014. These declines reflect the implementation of evidence-based tobacco prevention and control interventions, along with improvements in cancer prevention, detection, and treatment (8). Since tobacco-related cancer death rates began to decline, approximately 1.3 million tobacco-related cancer deaths have been averted. However, too many preventable tobacco-related cancer cases and deaths still are occurring. This analysis found that during 2009–2013, cigarette smoking caused 167,000 cancer deaths each year, about 30% of the 577,000 cancer deaths each year (6). Most of these deaths were from lung cancer, the leading cause of cancer deaths for both men and women (6). Furthermore, exposure to secondhand smoke could account for an additional 7,300 lung cancer deaths among nonsmokers (1).

At least half of persons who continue to smoke are expected to die from a tobacco-related disease, although tobacco cessation significantly decreases this risk (9). Therefore, among the 36.5 million people in the United States who currently smoke cigarettes (10), about 18.25 million might die prematurely from a tobacco-related disease, including 6 million from cancer, unless strategies are implemented to help them quit. Many tobacco-related cancers could be prevented by reducing tobacco use through sustained, comprehensive, evidence-based tobacco prevention and control interventions (8). These interventions include increased tobacco product prices, implementation and enforcement of comprehensive smoke-free laws, aggressive mass media campaigns, and promotion of smoking cessation resources proven to help users quit tobacco use (11). States that have invested more fully in tobacco prevention and control programs generally have experienced larger declines in youth and adult smoking prevalence, decreases in lung cancer, and reduced tobacco-related health care costs (11). A recent report found that smoking-attributable cancer mortality varied by state from 17% to 34% and suggested that disparities in cancer deaths among states can be explained in part by differences in smoking prevalence (12). In this report, tobacco-related cancers declined across most demographic groups, but not at the same pace, and not in all states. Funding state tobacco control programs at CDC-recommended levels can accelerate progress toward reducing tobacco-related cancers (11).

Although many factors might contribute to tobacco-related cancer disparities, they generally align with disparities in cigarette smoking prevalence by sex, geography, and socioeconomic status (10). Identifying and eliminating tobacco-related disparities is a goal of CDC's National Tobacco Control Program, which provides funding and technical support to state and territorial health departments.<sup>††</sup> CDC also funds the Consortium of National Networks to Impact Populations Experiencing Tobacco-Related and Cancer Health Disparities, which seeks to advance tobacco use prevention and cancer prevention among persons at highest risk for tobacco use.<sup>§§</sup>

Preventive services recommended by the U.S. Preventive Services Task Force relevant to tobacco-related cancers include tobacco cessation counseling and treatment as well as screening for cervical, colorectal, and lung cancers to help detect these diseases at an early, and often treatable, stage.<sup>¶¶</sup> Screening also can detect precancerous cervical lesions and precancerous colorectal polyps which can be treated to prevent progression to cancer. Vaccination against hepatitis B

virus and human papillomavirus, as recommended by the Advisory Committee for Immunization Practices, could prevent some cancers (liver and cervix) to which both tobacco and infectious agents can contribute.<sup>\*\*\*</sup> The Affordable Care Act increased access to recommended preventive services through expanded insurance coverage and eliminating cost-sharing; however, coverage and barriers to treatment vary by type of insurance and state (13,14). CDC's National Comprehensive Cancer Control Program funds states, DC, tribes, and territories to work through state and local level cancer coalitions to ensure access to these early detection and treatment services, implement evidence-based programs to prevent cancer, and support cancer survivorship activities.<sup>†††</sup>

Federal initiatives can help reduce tobacco use and tobacco-related cancers. For example, a 1997 Executive Order established a smoke-free environment for federal employees and members of the public visiting or using federal facilities by prohibiting smoking of tobacco products in all interior space owned, rented, or leased by the executive branch of the Federal Government.<sup>§§§</sup> A key priority of the Cancer Moonshot, a recently launched large-scale federal initiative, is to accelerate understanding of cancer and promote its prevention.<sup>¶¶¶</sup> To help inform the Moonshot initiative, the Blue Ribbon Panel, a working group of the National Cancer Advisory Board, recommended implementation research to achieve wider adoption of existing evidence-based tobacco control, cancer prevention, and screening programs, especially to reach groups with the largest cancer disparities.<sup>\*\*\*\*</sup>

The findings in this report are subject to at least five limitations. First, rates among some racial and ethnic groups might be underestimated because race and ethnicity data are ascertained from medical records and death certificates and might be subject to misclassification (15). Second, while the most recent Surgeon General's Report was used to define tobacco-related cancers, this might underestimate the true burden because evidence is still accumulating that tobacco use might cause additional cancers (1). The burden also might be underestimated because this report did not include the contribution of tobacco use to adverse health outcomes among cancer patients such as poorer response to cancer treatment, higher treatment-related toxicity, higher risks of developing subsequent cancers, and higher risk of dying (1). Third, the smoking-attributable fraction for cancer deaths was based only on cigarette smoking and did not include harms related to other forms of tobacco use or secondhand smoke (3–5). Fourth, because information about tobacco use is not routinely collected by cancer registries or on death certificates, cancer cases and deaths included in this analysis might or might not be in persons who used tobacco. Fifth, cancers can be caused by many different factors, including tobacco use; therefore, the number of cases and trends in tobacco-related cancers might also be affected by changes in other risk factors, screening, or treatment.

Incidence and mortality from tobacco-related cancer declined during 2004–2013, continuing a longer-term trend. Comprehensive cancer control efforts, including evidence-based tobacco control interventions, can reduce tobacco use and the burden of cancer in the United States.

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## Acknowledgment

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Corresponding author: Jane Henley. [shenley@cdc.gov](mailto:shenley@cdc.gov). 770-488-4157.

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<sup>1</sup>Division of Cancer Prevention and Control, CDC; <sup>2</sup>Office on Smoking and Health, CDC; <sup>3</sup>Division of Cancer Control and Population Sciences, National Cancer Institute.

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\* Cancer registries demonstrated that cancer incidence data were of high quality by meeting the six USCS publication criteria: 1) case ascertainment ≥90% complete; 2) ≤5% of cases ascertained solely on the basis of death certificate; 3) ≤3% of cases missing information on sex; 4) ≤3% of cases missing information on age; 5) ≤5% of cases missing information on race; and 6) ≥97% of registry's records passed a set of single-field and inter-field computerized edits that test the validity and logic of data components. <http://www.cdc.gov/cancer/npcr/uscs/index.htm>.

† Cases were first classified by anatomic site using the International Classification of Diseases (ICD) for Oncology (ICD-O), Third Edition (<http://codes.iarc.fr/>) then cases with hematopoietic histologies were classified using the World Health Organization Classification of Tumours of Haematopoietic and Lymphoid Tissues, Fourth Edition (<http://www.bloodjournal.org/content/117/19/5019?sso-checked=true#T1>).

§ <http://seer.cancer.gov/coderecode>.

¶ Population estimates incorporate bridged single-race estimates derived from the original multiple race categories in the 2010 U.S. Census. <http://seer.cancer.gov/popdata/index.html>.

\*\* The county attribute variables were calculated using the Census American Community Survey 5-year (2009–2013) files. <http://seer.cancer.gov/seerstat/variables/countyattribs/#09-13>.

†† [http://www.cdc.gov/tobacco/stateandcommunity/tobacco\\_control\\_programs/ntcp/index.htm](http://www.cdc.gov/tobacco/stateandcommunity/tobacco_control_programs/ntcp/index.htm).

§§ <http://www.cdc.gov/cancer/ncccp/dp13-1314.htm>.

¶¶ <https://www.uspreventiveservicestaskforce.org/Page/Name/recommendations>.

\*\*\* <http://www.cdc.gov/vaccines/hcp/acip-recs/vacc-specific/hpv.html> and <http://www.cdc.gov/vaccines/hcp/acip-recs/vacc-specific/hepb.html>.

††† <http://www.cdc.gov/cancer/ncccp/index.htm>.

§§§ <https://www.archives.gov/federal-register/executive-orders/1997.html>.

¶¶¶ <https://www.whitehouse.gov/CancerMoonshot>.

\*\*\*\* <https://www.cancer.gov/research/key-initiatives/moonshot-cancer-initiative>.

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## References

1. US Department of Health and Human Services. The health consequences of smoking—50 years of progress: a report of the Surgeon General. <http://www.surgeongeneral.gov/library/reports/50-years-of-progress/index.html>
2. International Agency for Research on Cancer. IARC monographs on the evaluation of carcinogenic risks to humans. Volume 100E: personal habits and indoor combustions. Lyon, France: International Agency for Research on Cancer; 2012.
3. Henley SJ, Thun MJ. Chapter 4: health consequences of smokeless tobacco use. In: Hatsukami DK, Zeller M, Gupta P, Parascandola M, Asma S, eds. Smokeless tobacco and public health: a global perspective. Bethesda, MD: US Department of Health and Human Services, CDC, National Institutes of Health, National Cancer Institute. NIH

Publication No. 14-7983;2014.

4. National Cancer Institute. Smoking and tobacco control monograph 9. Cigars: health effects and trends. Bethesda, MD: US Department of Health and Human Services, National Institutes of Health, National Cancer Institute; 1998.
5. US Department of Health and Human Services. The health consequences of involuntary exposure to tobacco smoke: a report of the Surgeon General. Atlanta, GA: US Department of Health and Human Services, CDC; 2006.
6. US Cancer Statistics Working Group. United States cancer statistics: 1999–2013 incidence and mortality web-based report. Atlanta, GA: US Department of Health and Human Services, CDC, National Cancer Institute; 2016. <http://www.cdc.gov/cancer/npcr/uscs/index.htm>
7. Siegel RL, Jacobs EJ, Newton CC, et al. Deaths due to cigarette smoking for 12 smoking-related cancers in the United States. *JAMA Intern Med* 2015;175:1574–6. [CrossRef](#) [PubMed](#)
8. Holford TR, Meza R, Warner KE, et al. Tobacco control and the reduction in smoking-related premature deaths in the United States, 1964–2012. *JAMA* 2014;311:164–71. [CrossRef](#) [PubMed](#)
9. International Agency for Research on Cancer. IARC handbooks of cancer prevention. Volume 11: reversal of risk after quitting smoking. Lyon, France: International Agency for Research on Cancer; 2007.
10. Jamal A, King BA, Neff LJ, et al. Current cigarette smoking among adults—United States, 2005–2015. *MMWR Morb Mortal Wkly Rep* 2016;65.
11. CDC. Best practices for comprehensive tobacco control programs—2014. Atlanta, GA: US Department of Health and Human Services, CDC; 2014. [http://www.cdc.gov/tobacco/stateandcommunity/best\\_practices/index.htm](http://www.cdc.gov/tobacco/stateandcommunity/best_practices/index.htm)
12. Lortet-Tieulent J, Goding Sauer A, Siegel RL, et al. State-level cancer mortality attributable to cigarette smoking in the United States. *JAMA Intern Med* 2016. Epub October 24, 2016. [PubMed](#)
13. Koh HK, Sebelius KG. Promoting prevention through the Affordable Care Act. *N Engl J Med* 2010;363:1296–9. [CrossRef](#) [PubMed](#)
14. McAfee T, Babb S, McNabb S, Fiore MC. Helping smokers quit—opportunities created by the Affordable Care Act. *N Engl J Med* 2015;372:5–7. [CrossRef](#) [PubMed](#)
15. Arias E, Heron M, Hakes JK. The validity of race and Hispanic-origin reporting on death certificates in the United States: an update. *Vital Health Stat* 2 2016(172).

**TABLE 1. Average annual number of tobacco-related invasive cancer cases and deaths,\* annual age-adjusted rate,† and annual percentage change (APC) between rates,§ by selected characteristics — United States,¶ 2004–2008 and 2009–2013**

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Characteristic	Cases					Deaths				
	2004–2008		2009–2013		APC	2004–2008		2009–2013		APC
	Rate	No.	Rate	No.		Rate	No.	Rate	No.	
Total	206.4	633,278	193.1	658,581	-1.3§	108.2	333,567	100.0	343,347	-1.6
<b>Sex</b>										
Male	269.6	364,639	249.7	383,201	-1.5§	142.9	189,596	130.5	196,784	-1.8

Female	158.0	268,640	148.4	275,380	-1.2 <sup>§</sup>	82.3	143,971	76.4	146,563	-1.4
<b>Age group (yrs)</b>										
<35	6.2	8,654	6.4	9,348	0.7 <sup>§</sup>	1.3	1,789	1.2	1,820	-0.6
35–44	51.5	22,162	50.4	20,531	-0.4 <sup>§</sup>	14.9	6,501	13.0	5,355	-2.6
45–54	175.3	75,551	170.7	77,150	-0.6 <sup>§</sup>	67.8	29,488	62.8	28,738	-1.6
55–64	433.8	136,361	404.2	151,794	-1.3 <sup>§</sup>	199.7	63,293	183.8	69,727	-1.6
65–74	901.9	171,985	824.9	184,891	-1.7 <sup>§</sup>	466.3	89,453	417.7	94,015	-2.1
≥75	1,225.6	218,565	1,144.6	214,867	-1.3 <sup>§</sup>	792.3	143,043	748.3	143,692	-1.1
<b>Race**</b>										
White	205.9	543,141	193.0	557,346	-1.2 <sup>§</sup>	107.3	286,575	99.7	292,714	-1.4
Black	221.7	66,733	205.2	72,218	-1.6 <sup>§</sup>	130.4	37,838	116.5	39,509	-2.2
American Indian/Alaska Native	150.6	3,212	139.8	3,890	-1.4 <sup>§</sup>	80.0	1,581	71.6	1,841	-1.9
Asian/Pacific Islander	145.0	16,156	134.2	19,477	-1.5 <sup>§</sup>	71.6	7,573	66.8	9,283	-1.4
<b>Ethnicity</b>										
Hispanic	163.3	36,747	150.3	43,730	-1.6 <sup>§</sup>	71.5	14,972	66.8	18,204	-1.4
Non-Hispanic	210.3	581,545	197.7	599,163	-1.2 <sup>§</sup>	110.9	318,088	102.7	324,470	-1.5
<b>County-level educational attainment (percentage of persons aged ≥25 years with at least a bachelor's degree)††</b>										
34.69%–74.39%	198.2	140,291	181.7	145,209	-1.7 <sup>§</sup>	99.3	58,519	89.7	74,021	—
28.75%–34.68%	198.8	140,424	185.1	145,638	-1.4 <sup>§</sup>	101.8	58,323	94.1	74,606	—
20.83%–28.74%	212.6	157,270	199.4	164,076	-1.2 <sup>§</sup>	110.5	70,125	103.2	90,486	—

3.23%– 20.82%	216.1	179,282	205.7	186,600	-0.9 <sup>§</sup>	117.0	80,768	111.2	104,235
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**County-level poverty (percentage of persons who live in poverty)**

9.2%–11.54%	202.1	146,185	186.7	153,065	-1.5 <sup>§</sup>	100.8	60,973	92.2	78,357
11.55%– 15.34%	205.4	153,910	192.0	159,632	-1.3 <sup>§</sup>	105.2	68,389	98.0	87,889
15.35%– 18.32%	206.6	156,529	192.8	162,009	-1.3 <sup>§</sup>	108.7	67,698	101.2	86,622
18.33%– 53.16%	213.0	160,642	201.9	166,818	-1.0 <sup>§</sup>	115.9	70,675	109.0	90,480

**County-level rural/urban continuum**

Metropolitan, population $\geq$ 1 million	204.4	311,592	189.4	323,403	-1.5 <sup>§</sup>	104.7	131,873	96.1	168,357
Metropolitan, population <1 million	207.1	194,452	194.3	203,475	-1.2 <sup>§</sup>	108.2	84,269	100.9	108,876
Urban	214.4	98,761	205.0	101,885	-0.8 <sup>§</sup>	115.5	45,667	110.1	58,404
Rural	209.3	12,463	201.8	12,760	-0.7 <sup>§</sup>	112.4	5,926	110.7	7,710

**U.S. Census region<sup>¶¶</sup>**

Northeast	215.7	131,576	201.5	131,725	-1.3 <sup>§</sup>	106.3	65,395	97.6	64,511	-1.7
Midwest	212.6	149,132	200.8	152,986	-1.1 <sup>§</sup>	112.3	79,019	105.0	80,416	-1.3
South	210.8	237,525	197.2	251,349	-1.3 <sup>§</sup>	113.8	127,087	105.0	133,044	-1.6
West	182.6	115,045	170.3	122,521	-1.4 <sup>§</sup>	96.1	62,067	88.3	65,376	-1.7

\* Tobacco-related cancers include cancers of the oral cavity and pharynx; esophagus; stomach; colon and rectum; liver; pancreas; larynx; lung, bronchus, and trachea; cervix; kidney and renal pelvis; urinary bladder; and acute myeloid leukemia.

† Per 100,000 persons, age-adjusted to the 2000 U.S. standard population.

<sup>§</sup> Trends were measured with annual percentage change (APC) in rates and were considered to increase or decrease if p<0.05; otherwise trends were considered stable. Trends marked with <sup>§</sup> were significant at p<0.05.

<sup>¶</sup> Cancer cases were compiled from cancer registries that meet the data quality criteria for all invasive cancer sites combined (covering approximately 99% of the U.S. population). Cancer deaths are from the National Vital Statistics System; mortality data are available through 2014 but are shown through 2013 for comparability with incidence data for which the most recently available data are from 2013.

<sup>\*\*</sup> Racial categories are not mutually exclusive from Hispanic ethnicity. Rates are not presented for patients with unknown or other race or unknown ethnicity. Incidence rates by ethnicity exclude data from Virginia because a large percentage of these cases were missing information on ethnicity.

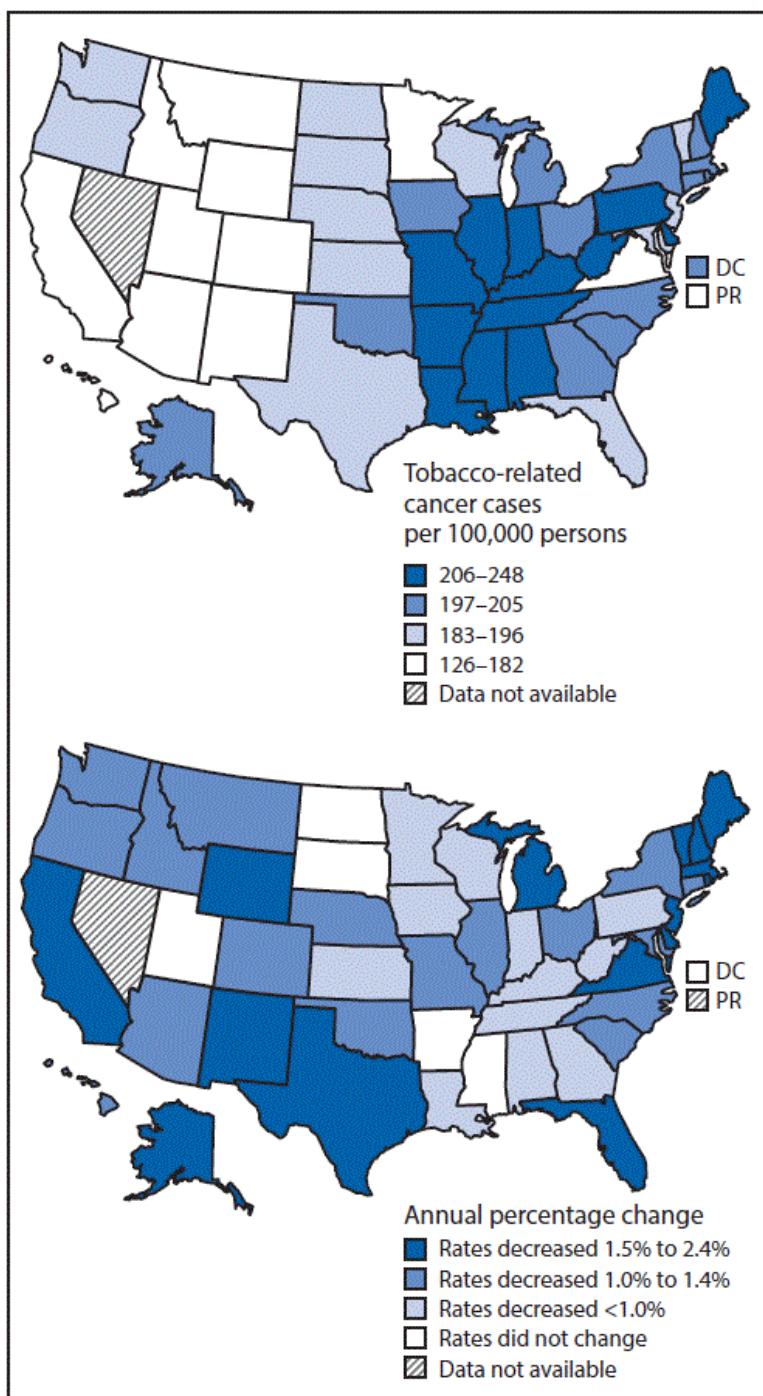
<sup>††</sup> Death rates for county-level characteristics are for the period 2005–2008 rather than 2004–2008.

<sup>§§</sup> The APC for death rates could not be calculated for county-level characteristics.

<sup>¶¶</sup> Northeast: Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont. Midwest: Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin. South: Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia. West: Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

**FIGURE 1. Annual age-adjusted rate\* of tobacco-related cancer<sup>†</sup> cases (2009–2013) and trends<sup>§</sup> in rates (2004–2013), by state — National Program of Cancer Registries, and Surveillance, Epidemiology, and End Results Program, United States**

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\* Per 100,000 persons, age-adjusted to the 2000 U.S. standard population.

<sup>†</sup>Tobacco-related cancers include oral cavity and pharynx; esophagus; stomach; colon and rectum; liver; pancreas; larynx; lung, bronchus, and trachea; cervix; kidney and renal pelvis; urinary bladder; and acute myeloid leukemia.

<sup>§</sup>Trends were measured with annual percentage change in rates and were considered to increase or decrease if  $p<0.05$ ; otherwise, trends were considered stable.

**TABLE 2. Average annual number of tobacco-related invasive cancer cases and deaths, annual age-adjusted rate,\* and number and smoking-attributable fraction (SAF) of**

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**deaths among adults aged  $\geq 35$  years,<sup>†</sup> by cancer site — United States, 2009–2013<sup>§</sup>**

Cancer site	Cases						Deaths						Es ci %
	Males		Females		Total	Males		Females		Total	M SA %		
	Rate	No.	Rate	No.		Rate	No.	Rate	No.				
Oral cavity and pharynx	17.1	27,944	6.3	11,636	6	3.8	5,980	1.3	2,585	2	49	49	49
Esophagus	8.1	12,747	1.8	3,432	2	7.4	11,477	1.5	2,959	4	5	5	5
Stomach	9.2	13,957	4.6	8,573	3	4.5	6,663	2.4	4,549	3	2	2	2
Colon and rectum	46.8	71,485	35.5	66,486	21	18.1	26,956	12.7	24,845	15	1	1	1
Liver	10.8	17,983	3.2	6,082	4	7.4	12,104	2.3	4,524	5	2	2	2
Pancreas	14.1	21,516	10.9	20,769	6	12.5	19,004	9.5	18,526	11	1	1	1
Larynx	6.2	9,923	1.4	2,575	2	1.9	2,937	0.4	752	1	7	7	7
Lung, bronchus, and trachea	74.7	113,223	53.4	99,895	32	57.9	87,032	37.1	70,566	46	8	8	8
Cervix uteri	NA	NA	7.6	12,299	2	NA	NA	2.3	4,046	1	N	N	N
Kidney and renal pelvis	21.7	34,147	11.3	20,569	8	5.7	8,626	2.5	4,814	4	2	2	2
Urinary bladder	36.1	52,876	8.9	16,959	11	7.7	10,649	2.2	4,341	4	2	2	2
Acute myeloid leukemia	5.0	7,400	3.4	6,105	2	3.7	5,355	2.2	4,057	3	2	2	2

All tobacco-related cancers	249.7	383,201	148.4	275,380	100	130.5	196,784	76.4	146,563	100	5
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**Abbreviations:** NA = not applicable.

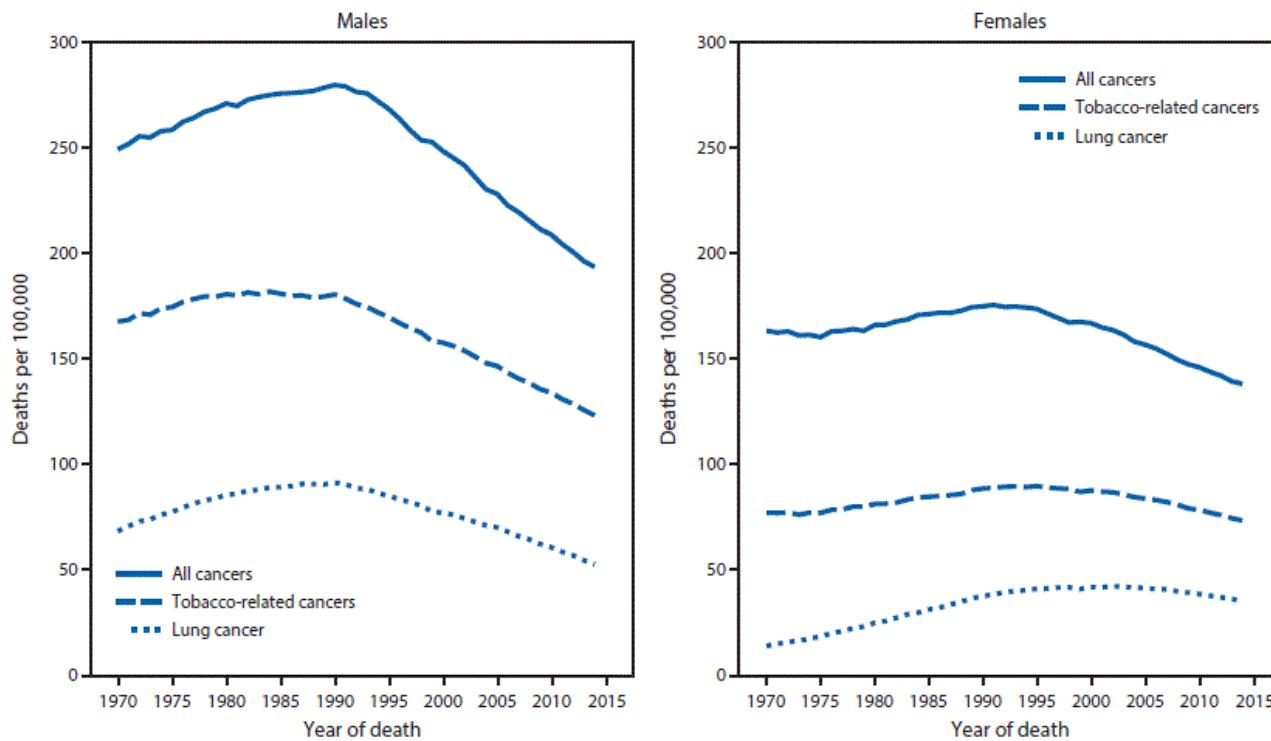
\* Per 100,000 persons, age-adjusted to the 2000 U.S. standard population.

† Estimates for SAF were based on Siegel RL, Jacobs EJ, Newton CC, et al. Deaths due to cigarette smoking for 12 smoking-related cancers in the United States. JAMA Int Med 2015;175:1574–6.

§ Cancer cases were compiled from cancer registries that meet the data quality criteria for all invasive cancer sites combined (covering approximately 99% of the U.S. population). Cancer deaths are from the National Vital Statistics System; mortality data are available through 2014 but are shown through 2013 for comparability with incidence data for which the most recently available data are from 2013.

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## FIGURE 2. Trends in age-adjusted death rates\* from all cancers combined, all tobacco-related cancers,† and lung cancer, by sex — National Vital Statistics System, United States, 1970–2014



\* Per 100,000 persons, age-adjusted to the 2000 U.S. standard population.

† Tobacco-related cancers include oral cavity and pharynx; esophagus; stomach; colon and rectum; liver; pancreas; larynx; lung, bronchus, and trachea; cervix; kidney and renal pelvis; urinary bladder; and acute myeloid leukemia.

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